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refracted band being much too weak to show details. All through this series of photographs the more refracted of the two bands has been the stronger, and the stronger components of each have been of shorter wave-lengths.

The band at 495·9 on December 20 contains two sharply defined brighter lines near its edges, at 495·1 and 497·0; and the same marking, near the edges, appears in Hβ and in the band 500·7. The photograph of this date was by a remarkably successful exposure in a very clear sky, and compares well with the photograph of August 27. On a careful re-examination of this plate the same structure has been found in the bands 495·9 and 500·7, but only doubtfully in Hβ.

Stonyhurst College Observatory:
1902 *May.*

Series in the Nebular Spectrum, and in the Bright-Line Spectrum of Nova Persei. By E. F. J. Love, M.A., Assistant Lecturer and Demonstrator of Natural Philosophy in the University of Melbourne.

§ 1. *Introductory.*

Soon after the spectrum of Nova *Persei* had assumed the nebular type, Lockyer[*] and Sidgreaves[†] called attention to the abnormal brightness of three of the lines, compared with that of the "chief" nebular line at λ 5007; Sidgreaves further showed that these lines were characterised, in the Nova spectrum, by identity of structure, while the other lines present had a very different appearance. The wave-lengths of these lines, as estimated by different observers, group round the values λ 4363, λ 3968 and λ 3869.

It seemed to me likely that three lines so closely resembling each other might belong to a series of the general type investigated by Kayser and Runge; I therefore made the attempt to find one, with the results detailed in this paper.

§ 2. *Deduction of Series, and Comparisons with Nebular Lines.*

Since the identification of the lines above-mentioned with nebular lines seems to be beyond dispute, I preferred to use their wave-lengths as measured in nebular spectra, since these have recently been redetermined with great exactness at the Lick Observatory[‡] by Wright, in the course of the observations on

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[*] *Proc. Roy. Soc.* vol. lxix. p. 133; *Monthly Notices*, vol. lxii. App. p. 1.

[†] *Monthly Notices*, vol. lxii. p. 137.

[‡] *Astrophysical Journal*, vol. xiv. p. 267.

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Nova *Persei*. The values given by him are 4363·3, 3967·6 and 3868·9; these I find to be included in a series of the form

$$\lambda^{-1} = A + Bn^{-2} - Cn^{-4}$$

where λ^{-1} denotes the number of waves per centimetre, $A = 25739$, $B = 43108$, $C = 1412208$, and n has the values 4, 5 and 6 for the three lines. The series relation therefore exists.

Recalling the important fact that the relative intensity of these lines increases as we go towards the violet—exactly the reverse of the usual behaviour of series lines [*]—it seemed worth while to extend the series, and see if it included other bright nebular lines. Making the calculation I find that $n = 8$ gives the wave-length [†] of a line observed by Campbell [‡] in the spectrum of the *Orion* nebula, while among higher members of the series I find wave-lengths corresponding to those of a number of lines observed by Huggins [§] in the spectrum of the trapezium stars and surrounding parts of the *Orion* nebula. Going in the other direction, I find that $n = 3$ gives a wave-length so far down in the extreme red—it corresponds nearly to the middle of the A band in the solar spectrum—as to be extremely difficult to observe in a nebular spectrum, supposing it were present.

The observed and computed values are collected in the following table; it must be noted that—except in the case of the three lines used in deducing the formula—the wave-lengths are only given, by the several investigators, to the nearest tenth-metre.

TABLE.

n	λ^{-1} calcd. (waves per cm.)	λ calcd. (tenth-metres.)	λ obsd. (tenth-metres.)	Observer.	Notes.
3	13104	7631·3	...	...	Not observed.
4	22917	4363·3	4363·3	Wright.	Used to deduce the formula.
5	25204	3967·6	3967·6	„	
6	25847	3868·9	3868·9	„	
8	26068	3836·1	3836	Campbell.	Orion nebula.
10	26029	3841·9	3842	Huggins.	Orion nebula and trapezium.
13	25945	3854·3	3854	„	„ „ „

If it be legitimate to include $n + \frac{1}{2}$, we obtain two other identifications.

11·5	25985	3848·4	3848	Huggins.	Orion nebula and trapezium.
14·5	25912	3859·2	3859	„	„ „ „

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[*] Can the positive sign of the term involving B—which is also the reverse of the usual case—be connected with this fact?

[†] The minimum possible wave-length for the series; proved by differentiating the equation.

[‡] *Astronomy and Astrophysics*, vol. xii. p. 273.

[§] *Proc. Roy. Soc.* vol. xlvi. p. 40.

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The inclusion of the last two lines seems legitimate, as it introduces a symmetry in the values of n which would not otherwise exist; we may then, starting from $n = 8$, arrange the lines in two groups, the successive differences being

$$(n = 8)\begin{cases} 2,\ 1,\ 1,\ 1. & \text{First group.} \\ 2,\ 1\tfrac{1}{2},\ 1\tfrac{1}{2},\ 1\tfrac{1}{2}. & \text{Second group.} \end{cases}$$

It seems inadvisable to carry the table further; if n exceed 15, an increase of a unit in its value changes the wave-length by only $2\frac{1}{2}$ tenth-metres; if it exceed 20, we obtain values which might fit almost any line, between λ 3868 and λ 3885, not very accurately measured.

§ 3. *Remarks on the Identifications in the Table.*

1. Campbell identifies λ 3836 with β (otherwise known as $H\eta$), but this seems to me very doubtful. At the time of his observations everyone believed λ 3968 to be $H\epsilon$, but this is now known, from Wright's investigation, to be a mistake; $H\epsilon$ is indeed present, side by side with an "unknown" line, but it is very faint, while its unknown companion is bright; hence $H\eta$, if present at all, should be a still fainter line, but Campbell marks λ 3836 as "bright" in his table. It is true that he also identifies another bright line, at λ 3889, with α (or $H\zeta$); but in view of the behaviour of $H\epsilon$ this may be attributed—with at least equal probability—to helium,* which has a strong line at λ 3888·8. Moreover the differences between the wave-lengths of the ultra-violet hydrogen lines and those identified with them by Campbell are much larger than any of the differences in the case of other, and quite certain, identifications; judging from these I find it much easier to believe some of Campbell's identifications wrong than to believe that his measurements are incorrect by three and four tenth-metres.†

2. Huggins's lines form part of a cluster, distinct and fairly strong in the spectrum of the trapezium stars, and extending into that of the surrounding nebula; so far they have not been obtained from other parts of the nebula. Two of the cluster, λ 3832 and λ 3825, do not belong to the series. Another line, equal in length on the plate to those identified above,‡ and of about the same order of brightness—measured by Huggins as λ 3870—is possibly identical with λ 3869; but this seems

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* The helium spectrum was not known at the time of Campbell's observations; we have since learnt that it accounts for a number of lines in the spectrum of the Orion nebula.

† In view of the above arguments I am inclined to think that the hydrogen series, beyond $H\epsilon$, has probably not yet been detected in nebular spectra.

‡ And therefore, presumably, emitted from the same part of the nebula.

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improbable, as neither the lower members of the series, nor λ 3836, are represented in the photograph.*

University of Melbourne:
1902 *March* 18.

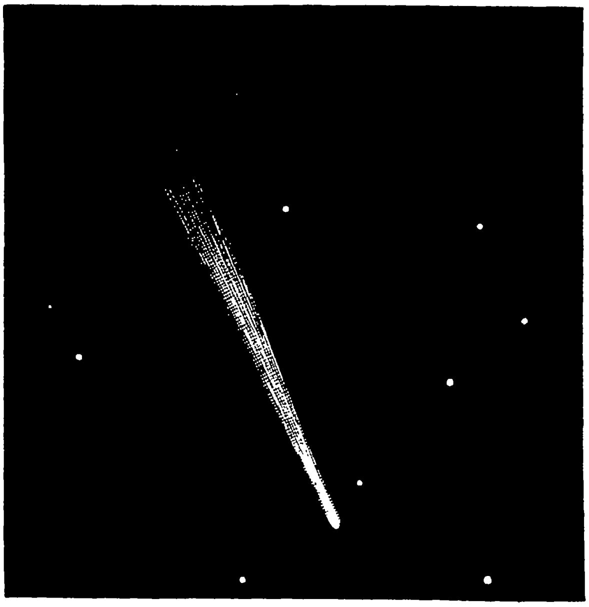
Discovery of Comet Brooks, 1902. By William R. Brooks, D.Sc.

I have the honour to announce to the Society the discovery of a new comet.

While sweeping the eastern sky on the morning of April 14, I picked up an object in *Pegasus*, which I at once suspected to be a comet. Its position at $21^h\ 5^m$ G.M.T. was approximately R.A. $22^h\ 55^m\ 40^s$, Decl. $+29°\ 12'$. A slight haze and advancing twilight made me hesitate about making a public announcement, but a telegram was sent that morning to Harvard College Observatory of the suspected object.

The following morning was awaited with much interest, which fortunately was clear. The object, it was immediately noticed, had moved from the discovery field and was soon found about three degrees nearer the Sun. Its place on April 15, 21^h G.M.T., was R.A. $23^h\ 8^m\ 10$, Decl. $+27°\ 25'$. This gave a daily motion of about 12^m east and 2° south.

The comet is a fairly bright telescopic object. It has a very minute stellar nucleus and a short narrow tail.



Comet *Brooks*, 1902.

Smith Observatory, Geneva, N.Y., U.S.A.

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* The double grouping, exhibited in § 2, may account for the absence of the other radiations from this part of the nebula, and of these from other portions where they are present.